Claims

1. A method of decoding a received spread OFDM wireless communication signal comprising: performing an equalizing and decision function on the received spread OFDM signal (y), splitting the equalized and decided spread OFDM signal block ($\hat{s}$) into a number 2^i of portions ($\hat{s}_1$, $\hat{s}_2$, $\hat{s}_3$, $\hat{s}_4$), such that $\hat{s}=\begin{bmatrix}\hat{s}_1\\ \hat{s}_2\\ \hat{s}_3\\ \hat{s}_4\\ \vdots\end{bmatrix}$, where i is positive integer;

characterised by:

for each of said portions ($\hat{s}_1$) of the equalized and decided signal block in turn subtracting values M ($M\begin{bmatrix}0\\ \hat{s}_2\\ \hat{s}_3\\ \hat{s}_4\\ \vdots\end{bmatrix}$) derived from the other portions ($\hat{s}_2$ to $\hat{s}_4$ ...) of the equalized and decided signal block from the received signal block (y) to produce a respective difference signal, where $M=H\cdot W$, H is an NxN diagonal matrix related to the complex frequency channel attenuations and W is an NxN unitary spreading matrix; and performing an equalising and decision function on the respective difference signal to produce a further processed equalized and decided portion ($\hat{\hat{s}}_1$) of the received signal in which interference due to the other

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portions ($\hat{s}_2$ to $\hat{s}_4$) of the equalized and decided signal block is substantiallyreduced;
the steps of producing the respective difference signal and performing the equalising and decision function to produce the further processed equalized and decided portion being repeated for each of the other portions ($\hat{s}_2$, $\hat{s}_3$, $\hat{s}_4$) of the signal block.

2. A method as claimed in claim 1 wherein repeating subtracting the values derived from other portions of the equalized and decided signal block from the received signal to produce a respective further difference signal comprises subtracting values derived from at least one of said further processed portions ($\hat{\hat{s}}_2$ to $\hat{\hat{s}}_4$) of the received signal from the received spread OFDM signal (y).

3. A method as claimed in claim 1 or 2 further comprising iterating processing the signal block, including iterating the steps of producing the respective difference signal and performing the equalising and decision function to produce the further processed equalized and decided portion with values derived from the further processed portions ($\hat{\hat{s}}_1$ to $\hat{\hat{s}}_4$) in place of previously processed portions ($\hat{s}_1$ to $\hat{s}_4$), to recover still more reliable estimates for each of the portions.

4. A method as claimed in claim 3 wherein iterating processing the signal block includes splitting the equalized and decided spread OFDM signal block ($\hat{s}$) into a number 2^j of portions ($\hat{s}_1$ to $\hat{s}_4$), where j is a positive

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integer greater than i so that iterating the steps of producing the respective difference signal and performing the equalising and decision function to produce the further processed portion is performed with a greater number of portions than the previous steps.

5. A method as claimed in any preceding claim wherein said equalizing steps comprise multiplying by a first diagonal matrix having elements dependent on channel coefficients; and
multiplying by a second matrix which is a subset of a Walsh Hadamard matrix.

6. A method as claimed in any preceding claim wherein said equalizing steps comprise performing minimum mean square error equalization.

7. A receiver (160-180) for use in a spread OFDM wireless communication system (100), the receiver comprising
means for receiving a spread OFDM wireless communication signal, and decoding means for decoding the received signal by a method as claimed in any preceding claim, said decoding means comprising:
equalizing and decision means for performing said equalizing and decision function on the received spread OFDM signal (y),

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means for splitting the equalized and decided spread OFDM signal block ($\hat{s}$) into a number 2^i of portions ($\hat{s}_1$, $\hat{s}_2$, $\hat{s}_3$, $\hat{s}_4$), such that $\hat{s}=\begin{bmatrix}\hat{s}_1\\ \hat{s}_2\\ \hat{s}_3\\ \hat{s}_4\\ \vdots\end{bmatrix}$, where i is positive integer;

characterised by:

subtracting means for subtracting, for each of said portions ($\hat{s}_1$) of the equalized and decided signal block in turn, said values M ($M\begin{bmatrix}0\\ \hat{s}_2\\ \hat{s}_3\\ \hat{s}_4\\ \vdots\end{bmatrix}$) derived from the decided other portions ($\hat{s}_2$ to $\hat{s}_4$ ...) of the equalized and decided signal block from the received signal block (y) to produce a respective difference signal, where $M = H \cdot W - H$ is an NxN diagonal matrix related to the complex frequency channel attenuations and W is an NxN unitary spreading matrix;

said equalizing and decision means being arranged to perform said equalising and decision function on the respective difference signal to produce said further processed equalized and decided portion ($\hat{\hat{s}}_1$) of the received signal in which interference due to the other portions ($\hat{s}_2$ to $\hat{s}_4$) of the equalized and decided signal block is substantially reduced;

and said decoding means being arranged to repeat, for each of the other portions ($\hat{s}_2$, $\hat{s}_3$, $\hat{s}_4$) of the signal block, said steps of producing the respective difference signal and performing the equalising and decision

function to produce the further processed equalized and decided portion.

8. A receiver as claimed in claim 7 wherein said subtracting means is arranged so that repeating subtracting the values derived from the other portions of the equalised and decided signal block from the received signal to produce a respective further difference signal comprises subtracting values derived from at least one of said further processed portions ($\hat{\hat{s}}_2$ to $\hat{\hat{s}}_4$) of the received signal from the received spread OFDM signal (y).

9. A receiver as claimed in claim 7 or 8 wherein said decoding means is arranged to iterate processing the signal block, including iterating the steps of producing the respective difference signal and performing the equalising and decision function to produce the further processed equalized and decided portion with values derived from the further processed portions ($\hat{\hat{s}}_1$ to $\hat{\hat{s}}_4$) in place of previously processed portions ($\hat{\hat{s}}_1$ to $\hat{\hat{s}}_4$), to recover still more reliable estimates for each of the portions.

10. A receiver as claimed in claim 9 wherein said decoding means is arranged so that iterating processing the signal block includes splitting the equalized and decided spread OFDM signal block ($\hat{s}$) into a number 2^j of portions ($\hat{s}_1$ to $\hat{s}_4$), where j is positive integer greater than i so that iterating the steps of producing the respective difference signal and performing the

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equalising and decision function to produce the further processed portion is performed with a greater number of portions than the previous steps.

11. A receiver as claimed in any of claims 7 to 10 wherein said equalizing and decision means comprises matrix multiplication means for multiplying by a first diagonal matrix having elements dependent on channel coefficients and by a second matrix which is a subset of a Walsh Hadamard matrix.

12. A receiver as claimed in any of claims 7 to 11 wherein said equalizing and decision means comprises means for performing minimum mean square error equalization.

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